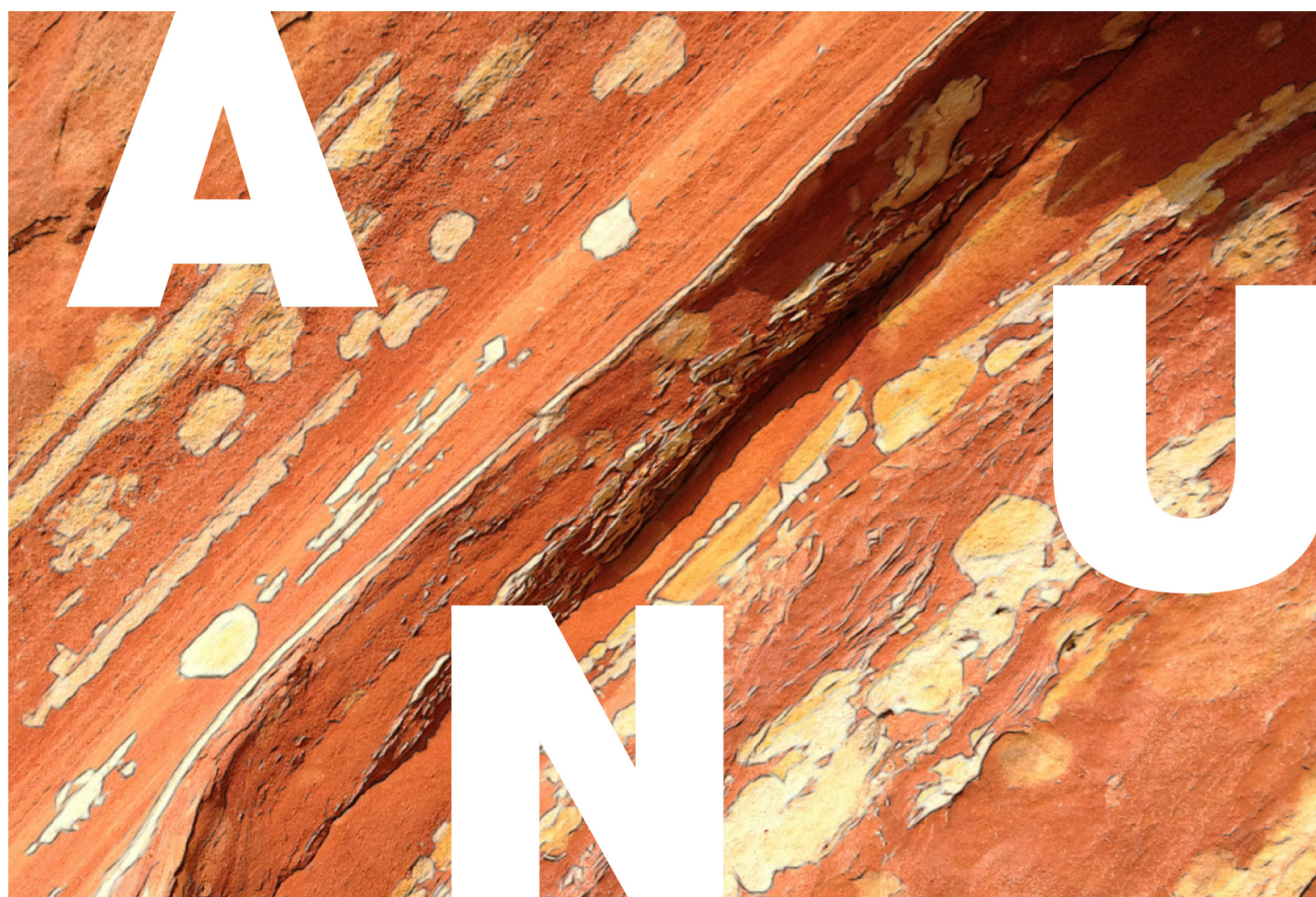




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INDIGENOUS YOUTH ENGAGEMENT IN
NATURAL RESOURCE MANAGEMENT IN
AUSTRALIA AND NORTH AMERICA:
A REVIEW

A. FORDHAM AND R.G. SCHWAB

Centre for
Aboriginal Economic
Policy Research
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[Arts & Social
Sciences](#)

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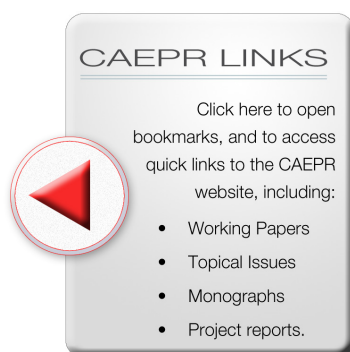
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Indigenous youth engagement in natural resource management in Australia and North America: A review

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Abstract

With the continuing high levels of Indigenous youth unemployment and low levels of school attendance among Indigenous youth, Indigenous communities and education systems are seeking new approaches to increase Indigenous youth participation in education, training and employment. This priority among Indigenous and government stakeholders is not restricted to Australia but also applies internationally among many Indigenous peoples. One potential source of employment is the natural resources sector. This paper reviews the wide range of strategies currently being used to encourage Indigenous youth engagement in natural resource management as a way of achieving better educational outcomes and improving employment opportunities. Examples from Australia and North America are presented. These examples highlight the importance of both Indigenous knowledge and western science when developing suitable educational programs, and the role such programs can play in the intergenerational transmission of Indigenous knowledge. The review draws attention to the complexity involved in establishing clearly articulated pathways for Indigenous youth to enter and then retain employment in the natural resources sector and its management.

Keywords: Indigenous youth engagement, natural resource management, land and sea management, junior ranger programs, remote communities, Indigenous education policy, Indigenous knowledge, science education.

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Acronyms

CDEP	Community Development Employment Projects
DEEWR	Department of Education, Employment and Workplace Relations
FNFP	First Nations Forestry Program
GIS	geographic information system
GPS	global positioning system (technology)
JCR	Junior Canadian Ranger
KLC	Kimberley Land Council
MCEECDYA	Ministerial Council on Education, Early Childhood Development and Youth Affairs
MCEETYA	Ministerial Council on Education, Employment, Training and Youth Affairs
NAISMA	North Australia Indigenous Land and Sea Management Alliance
NLC	Northern Land Council
YRITWC	Yukon River Inter-Tribal Watershed Council

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Introduction

The engagement of Indigenous young people in education, training and employment remains a critical issue for the future wellbeing of Indigenous communities across Australia. This is despite numerous Commonwealth and State government initiatives to address the large disparities between Indigenous and non-Indigenous rates of labour force participation, unemployment and postsecondary education and training participation. At the national level in 2006, Indigenous youth unemployment rates were more than double that of non-Indigenous youth (22% compared to 10%) and actual participation in the labour force was some 20 per cent lower than that of non-Indigenous youth; unemployment rates for Indigenous youth were also significantly higher (11% compared to 5%) than for older Indigenous age-groups (Australian Bureau of Statistics 2010). Education and training rates were also different, with 35 per cent of Indigenous Australians aged 15–24 years attending formal education in 2006, compared to 55 per cent of non-Indigenous Australians (Biddle 2010). More recent labour force surveys do not suggest that substantial progress is being made in ‘closing the gap’ between Indigenous and non-Indigenous youth unemployment.

In remote Australia generally, employment opportunities for young Indigenous people have been limited to a small number of local government agencies and Indigenous organisations delivering services to their community. In a few remote locations natural resource extraction industries such as mining have been a source of employment for some young people. Overall, opportunities for young workers have remained quite limited. While employment options are sometimes greater in rural regions, unemployment rates among Indigenous youth typically remain high.

One of the few new opportunities for employment in remote and rural regions has arisen from the expanding land and sea management programs being undertaken by Indigenous communities across Australia. This paper represents an initial exploration into how natural resource management programs in Australia might be adapted to meet the particular needs of Indigenous young people, and increase their employment in the sector. In so doing, the paper draws upon Australian and international examples of natural resource management involving Indigenous youth, and includes commentary on the nature of science education and training which underpins much of their involvement.¹

While one cannot assume that all Indigenous youth would necessarily be interested in pursuing employment in natural resource management, there is good reason to consider it

a viable option for a significant number of them, including those not living in remote Australia. First, there is some evidence that youth in general (both non-Indigenous and Indigenous) hold strong views about the ecological value of government- and Indigenous-managed conservation areas and are concerned about their maintenance as a result of the impact of climate change, drought, acid rain, water quality, introduced invasive species and other environmental threats (Jana, Koss & Facer 2008). Analysis of student views in developed and developing countries provides similar evidence, although students in developing countries tended to show more concern for environmental challenges and hold a greater belief in their personal capacities to address environmental challenges (Trumper 2010). Though there is much optimism, the warning from Jana, Koss and Facer (2008: 47) in regard to Indigenous youth cannot be dismissed lightly:

As the forces of modernity drive newer generations away from the natural world, the apathy of youth to nature is escalating. The problematic situation is reflected more amidst indigenous and local rural youth as their links with nature and natural resources are increasingly jeopardised and the passing of ecological knowledge base and cultural traditions associated with nature from older generations are obstructed.

However, many of the activities underpinning natural resource management align with the custodial responsibilities for the environment held by Indigenous land owners and passed on to Indigenous young people. Natural resource management programs therefore have significant appeal in providing the opportunity to exercise this responsibility to care for traditional lands. Finally, in many communities—especially those that are geographically remote—employment options for Indigenous young people are extremely limited, and while jobs in natural resource management cannot provide for every job seeker, it is a sector where there is growth.

The engagement of Indigenous young people in natural resource management can have multiple benefits in providing for some young people a career path where employment options are otherwise limited, involving work that has cultural resonance with traditional values and obligations and that may in the end not only serve to protect the environment but to preserve and pass on traditional ecological knowledge and culture.

Indigenous People and Natural Resource Management in Australia

The Australian Government, through both international obligations and its own environmental policy framework, has introduced programs designed to facilitate sustainable and productive natural resource management as a means of maintaining Australia's biodiversity and redressing the decline in the health of Australia's landscapes, coastal environments and critical aquatic habitats (Caring for our Country 2011). In so doing, government policy recognises that the protection and management of country has been a traditional responsibility of Indigenous land owners for tens of thousands of years, and is critical to their spiritual, social and economic wellbeing. In the same way that government faces environmental challenges at a national level (e.g. invasive weeds and feral animals degrading land and aquatic habitats), Indigenous land owners face many of the same challenges but at a local level. These common challenges have been addressed, in part, through a notion of shared responsibility in delivering environmental outcomes, most evident in the establishment of Indigenous Protected Areas, designed to promote biodiversity and cultural resource conservation and provide increased Indigenous employment in natural resource management (Department of Sustainability, Environment, Water, Population and Communities 2011). The notion of shared responsibility therefore provides a basis for much program development in the area of natural resource management.

Over the last 20 years land and sea management has become an important source of Indigenous employment, particularly for Indigenous people living in the more remote areas of Australia. Indigenous ranger programs established in the early 1990s brought together traditional ecological knowledge and contemporary, science-based knowledge to create meaningful and sustainable employment in land and sea management within a culturally relevant context. By 2012 there were Indigenous ranger programs of one sort or another in every State and Territory in the nation, from the Arafura Sea off Australia's north coast, to the Kimberley in Western Australia and the Wild Rivers region of Northern Queensland, to the coastal regions of New South Wales and Flinders Island in Tasmania. Ranger responsibilities differ from region to region and from program to program but variously include conservation and monitoring activities related to weed and feral animal control, fisheries and waterways health, prescribed burning and coastal surveillance on behalf of Australian Customs.

Payments for environmental services such as these produce significant employment and economic development opportunities. These services can be delivered on behalf of both the government and private sector. For example, the Green Teams operating in rural areas of coastal New South Wales operate with a number

of small contracts for local and regional environmental services that provide a source of steady employment and income (Hunt 2010). Another example is the West Arnhem Land Fire Abatement project, a long-term arrangement for the provision of payments to an Indigenous organisation for an environmental service, in this case the abatement of 100,000 tonnes of carbon emissions through customary fire management practices as a carbon offset for a major international energy company (North Australia Indigenous Land and Sea Management Alliance (NAILSMA) 2006).

In some communities the ongoing land and sea management responsibilities of Indigenous rangers and traditional owners has provided a basis for commercially sustainable wildlife and 'bush' enterprises. Such enterprises have been established for the development and sale of 'bush foods' and native species such as freshwater turtles for the pet trade, saltwater crocodiles for meat and skins, and mudcrabs for the restaurant sector. Harvesting of plant and animal species for pharmaceutical and cosmetics purposes is also gaining some interest. Indigenous environmental knowledge has been utilised by the Indigenous pastoral industry, leading to improved land management practices, including better fire management, improved control of feral animals, weed control, and improved access to country, which provide cultural benefits for Indigenous land owners (Indigenous Pastoral Program n.d.).

Finally, mining exploration and extraction in remote locations across northern and western Australia, constitute another quite different and sometimes controversial aspect of the natural resource management sector. Mining leases such as Century Mine in Queensland; several mines operated by Rio Tinto and BHP, including the Rio Tinto mine in North Queensland; the Fortescue mine in the Pilbara; and the Argyle mine in the Kimberley have been an alternative source of training and employment for Indigenous people.

While there are many opportunities arising and benefits emerging from increasing Indigenous involvement in natural resource management, it is important to note that employment is only one of many significant outcomes. There is growing evidence that the cultural maintenance and custodial work that Indigenous rangers and others are involved in have indirect (and possibly direct) benefits in increased physical and mental health and decreased likelihood of criminal activity (Burgess et al. 2009; Weatherburn, Snowball & Hunter 2006; Weir, Stacey & Youngetob 2011).

Indigenous Youth Participation in Natural Resource Management in Australia

Until very recently there have not been any government programs targeted specifically at increasing youth participation, especially among Indigenous school leavers,

in natural resource management. Rather, ranger groups and Indigenous organisations are generally dependent upon utilising programs such as the Australian Government's Indigenous Employment Program and the Community Development Employment Projects (CDEP) program and/or State government traineeships, with training being undertaken in conservation and land management, aquaculture or other relevant courses. While there is no information readily available as to the number of Indigenous young people undertaking certificate-level courses in these areas across remote regions, the appropriateness of existing Conservation and Land Management Training Packages to Northern Territory land and sea management groups has been questioned. A recent review of Indigenous engagement in sustainable natural resource management called for the development of curriculum materials to complement existing Conservation and Land Management Training Packages to facilitate job readiness of those entering employment in the sector, as well as courses specific to the Northern Territory environmental, social and cultural landscape (Putnis, Josif & Woodward 2007).

Increasing youth participation and improved succession planning are priority areas addressed by various Indigenous organisations as a means of improving the capacity of Indigenous communities and ranger groups to deliver environmental services and manage natural resources. The strategies being used to increase youth participation, particularly among those young people who have left school, range from quite structured arrangements utilising government programs to quite informal arrangements. The range of strategies include:

- employing young people as trainee rangers, under the Australian Traineeship Program, to receive a combination of formal training, mentoring and work experience—for example at the Land and Sea Management Unit of the Kimberley Land Council (KLC) (KLC 2010)
- employing young people under programs such as Caring for our Country and encouraging participation in formal training in the Conservation and Land Management Certificate or related certificates—as done by the Murrumbidgee Catchment Management Authority (Caring for our Country 2006)
- providing training and mentoring in the delivery of environmental services by not-for-profit organisations with a charter of assisting Indigenous youth—the Silver Lining Foundation's Iron Bark Ridge Environmental Services offers fencing, forestry/plantation management and plant nursery services on a contractual basis, employing Indigenous youth in the south east Queensland (Noosa & District Landcare Group Inc 2010)
- offering opportunities for work experience, skill development and accredited training within the green and climate change industries—the National Green Jobs Corp program provides for Indigenous youth participation in the rehabilitation of the Mungalla Station's wetlands and enables training in global positioning system (GPS) technology, data-base applications and other equipment used in natural resource management (Herbert River Express 2010)
- linking senior traditional owners with young rangers to provide a mentoring role, involving intergenerational transfer of traditional knowledge related to land management issues—as at the Central Land Council (Central Land Council 2010)
- targeting youth as a priority for recruitment into natural resource management as a business priority and vital to succession planning, as done at the Northern Land Council (NLC) (NLC 2010).
- training and engaging Indigenous youth in the pastoral industry using apprenticeships and skills training in conservation and land management, with mentoring support as under the Indigenous Pastoral Program (see Indigenous Pastoral Program n.d.)
- establishing a residential program linking culture, agriculture and landcare as a culturally based alternative to juvenile detention where young people were at risk of becoming involved with the criminal justice system—the Tirkandi Inaburra Cultural and Development Centre won national recognition for this program in 2008 (Reconciliation Australia 2008; Tirkandi 2012)
- raising awareness among Indigenous youth of natural resource management issues, the importance of ecological knowledge and ethics associated with biodiversity conservation—for example, the Queensland Government Natural Resources Awareness Grants (Queensland Government 2012)
- training and engagement of Indigenous youth in Landcare programs. Examples of this include the rehabilitation of the Annabone Wetland in the Burdekin region (Queensland); coastal bushland rehabilitation in Eurobodalla (New South Wales); conservation planning for a whole-of-country approach among the Wuthathi people (Queensland); and recording Indigenous ecological knowledge of the Mardigan traditional owner group of south-west Queensland (Landcare 2010, 2011)
- helping Aboriginal people grow their own food and develop small-scale enterprises, thereby generating interest among Indigenous youth in horticulture, permaculture and land management (EON Foundation Inc. 2012; Remote Indigenous Gardens Network 2011).

Australian Programs and Pathways for Indigenous Youth: Three specific examples

In this section we examine in more detail three avenues that are being developed for encouraging Indigenous youth participation in the natural resource sector: junior ranger programs, Indigenous ranger cadetships and the role of resource extraction industries, particularly mining.

Learning through Country—the role of junior ranger programs

There is growing interest in the creation of ‘junior ranger’ programs as a means of developing employment pathways between schools and ranger groups, including both Indigenous ranger groups and Parks and Wildlife Service NT Rangers. This is consistent with reviews of existing Indigenous land and sea management services which highlight the importance of ranger groups working with local schools to develop junior ranger courses and provide work experience opportunities (Fogarty & Schwab 2012; Putnis, Josif & Woodward 2007; Ramsey et al. 2009).

Junior ranger programs—better described as ‘learning through country’ programs—have been developed at primary, junior secondary and senior secondary levels of education. The programs are designed to have three educational outcomes:

- increase school attendance and completion of secondary schooling for those most at risk of leaving school early
- re-engage early school leavers, and
- increase employment options and create employment pathways for school leavers.

At the same time, junior ranger programs possess an important role in facilitating the intergenerational transmission of Indigenous knowledge.

‘Learning through country’ programs have developed in various ways (Fogarty 2011). Ranger groups and their local Indigenous communities have been primary drivers for their development, with rangers recognising the importance of such programs for promoting the intergenerational transmission of Indigenous knowledge, particularly as it relates to the local land and sea environment, and learning more generally about ‘their country’. For example, the Dhimurru Aboriginal Corporation has been taking a lead role in developing a junior ranger program across north east Arnhem Land (Northern Territory) (Dhimurru Aboriginal Corporation, pers. comm. 2011). However the key feature

of this initiative is the high level of cooperation between the ranger groups and local schools.

Schools such as the Maningrida Community Education Centre have been another driving force for establishing junior ranger programs, viewing the program as a means of improving school attendance, increasing secondary school completion through more culturally relevant curricula and accessing work experience opportunities that are of interest to students (Fordham et al. 2010).

Several Aboriginal land councils have developed their own ‘learning on country’ programs. These are either highly structured and formal, incorporating topics linked to departmental curriculum requirements, or less formal and involving school students attending cultural camps. Tangentyere Landcare developed one of the first of these in their Land and Learning program for young people for use by schools in the region around Alice Springs (Tangentyere Landcare 2004). A less formal approach has been taken by the NLC (NLC, pers. comm. 2011)

Parks and Wildlife Service NT staff have played a significant role in implementing ‘learning through country’ programs, originally as out-of-school activities, especially during school holiday periods, but more recently as part of a school’s formal curriculum. Kakadu National Park has for many years sponsored the Kakadu Junior Ranger Program, beginning with Jabiru School and expanding to Pine Creek and Gunbalanya. The recent partnership between Parks and Wildlife Service NT and Kormilda College in developing a Junior Ranger Program within the science curriculum aims to increase student engagement with their environment and foster an association between Indigenous students’ first language and science (Department of Natural Resources, Environment, The Arts and Sport 2010; NAB Schools First 2010). This represents a significant shift in focus by Parks and Wildlife Service NT and one which is intended to strengthen their relationship with schools and ranger groups and contribute to ‘closing the gap’ in regard to Indigenous youth unemployment.

What is common to all learning through country programs is the linking of school, community and work as a pathway to employment—either in terms of land, sea or wildlife management employment, or by increasing job readiness for other sectors of the local labour market. Learning through country programs may be fully accredited courses of study or integrated with other courses of study, particularly science courses. That is, the more recently developed learning on country courses have moved beyond simply providing opportunities for work experience with ranger groups and information sharing about natural resource management initiatives.

For the natural resource sector, learning on country programs may provide the following benefits:

- provide opportunities for Indigenous students to learn about local culture and country and promote the intergenerational transmission of Indigenous ecological knowledge directly relevant to ranger activities
- develop western scientific skills and knowledge underpinning much of natural resource management, and
- increase student awareness of natural resource management as an employment option.

A recent development: the Indigenous Ranger Cadetship Program

In 2011 the Australian Government announced an Indigenous Ranger Cadetship Program for secondary school students which was planned to begin with implementation in six schools at the start of the 2012 school year, followed by another six in 2013 (Department of Education, Employment and Workplace Relations (DEEWR) 2011a). Though the start has been delayed to 2013, the aim of the program is to provide Indigenous young people with the necessary skills and knowledge to become rangers. Training will involve nationally-recognised qualifications in land management, heritage and cultural studies. Whilst several schools in remote regions of Australia, such as the Maningrida Community Education Centre, enrol secondary students in certificate-level Conservation and Land Management as part of their Vocational Education and Training in Schools Program, this government initiative has the potential to significantly influence youth engagement with the natural resource management sector.

The role of resource extraction industries

Through Indigenous Land Use Agreements, the resources extraction sector has supported the introduction of education and training programs leading to increased employment opportunities for Indigenous jobseekers (see summary of David Martin's commentary in Fordham & Schwab 2007b; O'Faircheallaigh 1995; Scambary 2007; Taylor & Scambary 2005). These Agreements have included:

- mentoring students through all levels of education
- specific undertakings about provision of traineeships and apprenticeships in their industry
- establishment of training programs and promotional processes to enable employees to attain all positions in the mining operation, not only positions requiring low skill levels, and

- support strategies designed to increase retention in jobs (including cross-cultural training).

The resource extraction sector potentially has an important role to play in supporting education, training and employment pathways for Indigenous youth living in remote regions. As a review of available research indicated, mining agreements offer opportunities for Indigenous youth to become employed in the sector and, in some instances, aim for skilled positions. Yet this does not seem to have occurred to any significant extent. Rather training programs and skill development have often been directed to immediate short-term employment opportunities and not to more sustainable employment beyond immediate requirements or, at best, the life of the mining operation (Fordham & Schwab 2007a). For example, the Vocational Training and Employment Centre, responsible for the delivery of training programs that the Fortescue Metals mining company believes best suits available employment opportunities (Fortescue Metals Group 2012), has drawn considerable, and sometimes controversial attention, due to the types of employment opportunities offered. However, as will be described below, international examples suggest there is enormous potential for the engagement of Indigenous young people initially as employees of resource extraction companies but eventually as co-managers of the local resources.

Indigenous Young People and Natural Resource Management in North America

Just as Australian Indigenous people hold custodial responsibilities for managing the health of their land and sea environments, so too do the Indigenous people of North America.² The maintenance of biodiversity programs to address polluted waterways, improve water quality and restore fish stocks, and the development of sustainable agriculture build upon traditional connections of North American indigenous people to their customary practices and the land—many of which have been disrupted or, in some cases, lost. As in Australia, high rates of Indigenous youth unemployment—often in regions where natural resources are abundant and the natural resource industries are strong—present challenges for engaging Indigenous youth in natural resource management.

This has been clearly identified as a critical issue for the Canadian forest industry. The sector recognises that Indigenous youth, often living where natural resources are abundant, are the largest demographic in Indigenous communities. With the close relationship many Indigenous youth hold with the natural environment, these young people represent a potential workforce to provide continuity for the sector (Parsons 2007). However the participation of Indigenous people and engagement of youth in the

natural resource sector remains quite limited. In regions such as British Columbia, where the forest industry dominates the natural resource economy (Prince 2005) and in Northern Alberta for both the forest and oil industry sectors, there is a need to increase First Nation and Metis youth participation (Henry & Anderson 2004; Taylor, Friedel & Edge 2009). Similar concerns have also been raised by Indigenous leaders in regard to the fishing industry, including aquaculture (Centre for Shellfish Research 2011).

Across Canada and the United States there is an extensive array of youth programs designed to increase the engagement of Indigenous youth in natural resource management. These include education programs, scholarships, traineeships and internships and summer camp activities. Some of the Canadian programs and activities developed and implemented with the aim of engaging First Nation and Metis Youth are described below.

- Developing training and employment pathways. Programs promote increased youth participation in the sector through career information and counselling, awareness raising programs, assistance to employers on recruiting and retaining Aboriginal youth in natural resource management, wage assistance to employers, and most importantly increasing the number of Aboriginal environmental practitioners to model good program delivery. One such program is the First Nations Forestry Program (FNFP) —a capacity building program to enhance the ability of First Nations to manage forest resources and participate in economic opportunities both on- and off- reserve across Canada (Eco Canada 2010; FNFP 2009, 2010).
- Encouraging Aboriginal youth to enter, remain and excel in the sciences and technology while respecting culture and traditional knowledge, with support programs in post-secondary education, mentoring programs and science camps (Aboriginal Affairs and Northern Development Canada 2011; Canadian Aboriginal Science and Technology Society 2005; FNFP 2009).
- Developing post-secondary courses of study in natural resources specifically for Aboriginal students. Courses reflect a complementarity between western science and traditional knowledge and custodial responsibilities in the protection and management of the environment (e.g. Nicola Valley Institute of Technology 2011).
- Partnering with industry to combine training in environmental monitoring and other aspects of natural resource management with job placements, often with assistance from government programs (e.g. Human Resources and Skills Development Canada 2011).
- Providing summer work experience through youth employment programs providing eight-week placements for three consecutive summers, thereby developing pathways from school to training and employment in science-based resource sectors (e.g. Aboriginal Youth Work Exchange Program (Ontario Ministry of Natural Resources 2011); First Nations Natural Resources Youth Employment Program (Confederation College 2011).
- Offering youth outreach activities (generally short-term camps) to introduce First Nation youth to traditional knowledge and promote cultural awareness of natural resources, as well as natural resource management employment options (FNFP 2009; Technical Services Advisory Group 2011). Alternatively, youth conferences on specific environmental issues such as climate change have been organised to encourage responsibility for environmental stewardship (Mushkegowuk Environmental Research Centre 2011).
- Recruiting government fisheries officers from First Nation communities and supporting youth activities such as canoe journeys have been a means of encouraging traditional aquatic activities, and a way to develop collaborative relationships between communities, youth and government (Fisheries and Oceans Canada 2009).
- Partnering with academic institutions to scope out possible curriculum opportunities and to expand natural resource databases to assist First Nations communities with training and attract youth, through bursaries, into science, environmental and economic fields related to fishery activities (e.g. Assembly of First Nations 2010; Environmental Stewardship Unit, Assembly of First Nations, pers. comm. 2011).

In reviewing the forest, oil and fishing industries of Canada it is evident that considerable emphasis is placed upon increasing Indigenous youth engagement through the development of education, training and employment pathways; encouraging the study of science, technology, engineering and mathematics; and developing education and training curricula that reflect both Indigenous ecological knowledge and western science (Henry 2006; Parsons & Brake 2006; Prince 2005).

North American Programs and Pathways for Indigenous Youth: Three Specific Examples

In this section we examine North American examples of junior ranger programs, internship models and school curricula that have achieved positive outcomes for engaging Indigenous youth in natural resource management.

Junior ranger summer programs and camps

The Junior Canadian Ranger (JCR) summer programs for Indigenous youth provide an important avenue through which many of these strategies are delivered. The JCR programs involving natural resource management have been developed in Ontario, Manitoba, Alberta and British Columbia, where the dominant focus is upon the forest industries, and to a lesser extent on to fisheries and the oil extraction industries. Participants are generally in senior secondary schooling and aged 16–18 years—a crucial time for future employment decisions. The programs are not necessarily restricted to Indigenous youth. Typically JCR programs aim to:

- increase the level of Indigenous employment in the forest industry
- encourage Indigenous youth to remain at secondary school
- create employment pathways from secondary and tertiary education to forest industry employment, and
- develop partnerships between First Nations, government and industry (Henry 2006).

The programs are often of about 3–8 weeks duration, held in the summer break, combine work-experience, fieldwork and classroom instruction and may require living in camp. Elders are involved to varying degrees and hold a key role in the transmission of traditional knowledge, values and culture. Training may be delivered by adult rangers, scientists and other specialist staff, and educators, covering topics such as trapping and forestry surveying, first aid and cardiopulmonary resuscitation, GPS and geographic information system (GIS) technologies.

Similar to the JCR camps, residential camps are a popular strategy to engage American Indian youth in natural resource management. A typical example is the Salmon Camp, a joint initiative of the Oregon Museum of Science and Industry and tribal leaders from a number of Native American tribes in the Northwest region of the United States. Salmon Camp blends western science, field experience and Indigenous ecological knowledge related to salmon fisheries through a series of residential camps for Native American youth. The aim of Salmon Camp is to expose urban and suburban youth with tribal affiliations to cultural and scientific knowledge related to salmon and their habitat, and to increase the number of Native Americans in science and information technology studies—ultimately to gain employment in those fields. Working with field scientists and conservation managers, the students participate in ongoing studies, data collection, analysis, and presentation of real research findings. An

external evaluation of the Salmon Camp project found the project to be highly successful in achieving its aims and objectives. Students report an increased sense of cultural identity and measurable and significant gains in their science, technology, engineering, and mathematics career preparation, as well as development of workplace skills (Oregon Museum of Science and Industry 2012).

Internships as a pathway to employment

Internships in various natural resource management industries are a well-established avenue for engaging North American Indigenous youth. A typical example is their application to the fishing industry. The Makah Education Program and Fisheries teamed up with Northwest Indian College (with funding from the National Marine Fisheries Service) to provide internships for Native American high school or graduated senior students who were interested in learning more about environmental and natural resource sciences, with a specific aim:

To excite Makah youth on opportunities in fisheries and environmental science and to encourage them to pursue a college degree in a related field so that they are qualified to be employed as future biologists and managers of the Makah Tribe (Makah Education Program 2011).

To increase the engagement of young people in managing the Salish Sea, the Tribal Journey Water Quality Project of the Coast Salish peoples offers internships for youth studying at the local tribal college to accompany representatives from the various tribal families responsible for monitoring water samples in the Strait of Georgia and Puget Sound (for more information on the Coast Salish peoples see Coast Salish Gathering 2010). These internships not only deliver training in western scientific method and actual work experience but provide an important means of intergenerational transfer of traditional ways to monitor and identify water quality. Youth are drawn from up to about 20 Tribes of the Coast Salish Gathering to undertake this training, which is supported by the United States Geological Survey (2011).

The Red Lake Walleye Recovery Program involves a partnership between the Red Lake Band of Chippewa Indians and the Minnesota State Department of Natural Resources, and provides youth internships over summer as an opportunity for work experience in fish stocking and population monitoring (Harvard Project on American Indian Economic Development 2006a).³ The program holds as a priority the education of the next generation of Chippewa Indians so that they will be able to manage the walleye population in a sustainable manner in the future. Internships are complemented by direct involvement of the program with the local school through the school curriculum and 'field work' (National Wildlife Federation 2011; Red Lake

Walleye Recovery Program, pers. comm. 2011). The importance of this natural resource management project is seen from an historical perspective, where earlier in the twentieth century, Chippewa Indian subsistence fishing was considered an 'honourable' lifestyle and involved all the family. As Record (2008) reports, for the young it provided a sense of identity and responsibility, teaching commitment, independence, reliability, and the value of hard work. Again, the program shows how traditional Indigenous cultural responsibilities for the health of fish stocks may translate into a pathway to employment.

School curricula as a pathway to natural resource management

This review identifies examples of school curricula across Years K–12, particularly science and mathematics curricula, that integrate Indigenous and western knowledge systems and which could prepare students for entry into resource management employment. Two quite different examples from North America are presented here, one in a rural agricultural setting in Wisconsin, the other in the remote Arctic region of Alaska, the Yukon and the North West Territories of Canada.

The Oneida Nation has re-acquired land in Wisconsin and is restoring its agricultural heritage, implementing culturally based programs and returning to its cultural roots in a modern sustainable way through the development of the Oneida Farms (Harvard Project on American Indian Economic Development 2005). This initiative links land use, water resources and traditional lifeways. The Oneida Nation implements educational programs across its school system that demonstrate the connections between cultivating land and cultivating the wellbeing of tribal citizens, drawing upon traditional agricultural practices used by the Oneida Nation in the eighteenth century and blending these with more contemporary practices. Such educational programs become an essential part of an employment pathway for Oneida youth through encouraging their interest in agricultural practices (Harvard Project on American Indian Economic Development 2005; Oneida Farms, pers. comm. 2011).

In the Yukon region, the Alaska Native Knowledge Network, located in the University of Alaska, the Alaska Science Consortium and the Alaska Rural Systemic Initiative have all played a prominent supporting role in the development of culturally responsive science and mathematics curricula across many schools (Alaska Native Knowledge Network 2011; Alaska Science Consortium 2011; Alaska Rural Systemic Initiative 2006). The Yukon River Inter-Tribal Watershed Council (YRITWC) adopted environmental education as a priority goal within its strategic planning, particularly for its youth. The Council established an educational program which emphasises the traditional values

of resource stewardship, in balance with job creation. This stewardship includes the enforcement of environmental standards, monitoring water quality and the health of the watershed, utilising traditional knowledge and guidance from tribal elders. As part of this broader community educational program, the YRITWC works closely with schools, providing work experience and input to science curricula in areas such as water sampling and monitoring, land management and sustainable energy use (Harvard Project on American Indian Economic Development 2006b; YRITWC 2008; YRITWC, pers. comm. 2011).

The complexity of developing culturally responsive curricula is best seen in the development of the Nunavut Land Program, an integrative science program in the North West Territories, involving multi-stakeholders working together to create the curriculum—individuals from the Qikiqani Inuit Association, Department of Culture, Language, Elders and Youth, the Nunavut Arctic College, and elders from the Department of Education, all with the common vision of engaging Nunavut youth in outdoor, traditional and scientific learning activities (Nunavut Department of Environment 2012).

In-school education is not 'stand-alone'. It is often complemented by summer courses and research sponsored by academic institutions and peak government and industry bodies such as the Native American Fish and Wildlife Society and the Sciences and Tribes Educational Partnership between Northwest tribes and the University of Washington (Thayer, Cullenberg & Garza 2007) to name just two of many supportive institutions. Complementing school curricula are tertiary programs that focus upon specialist scientific and technical qualifications for North American Indigenous youth and delivered by institutions such as the Nicola Valley Institute of Technology and the Nunavut Arctic College. In this way, education and training pathways to employment in natural resource management can be developed which lead to specialist occupations in the sector.

Youth Participation in Natural Resource Management in Other Countries

While the focus of this review has been upon engagement of Indigenous youth in Australia and North America in natural resource management, there are a wide range of natural resource management programs for young Indigenous people in other parts of the world. Some focus broadly on natural resource management. In New Zealand, for example, the Department of Conservation recently offered an intensive conservation program (Tauria Kaitiaki Taiao) for Maori cadets that combined Maori and Pakeha (European) practical knowledge and experience in land (Department of Conservation 2011). The aim of

that program was to build skills and to prepare workers for conservation projects among various iwi (local Maori peoples). Other programs are focused more specifically on the conservation of a particular species or habitat. For example, the Snow Leopard Conservancy, a United States organisation, has established a Snow Leopard Scouts program for young people in selected communities in Nepal, India, Pakistan and Russia. The aim of the program, involving school-based activities and for some a residential camp, is to build knowledge and support for conservation efforts to protect the endangered Snow Leopard (Snow Leopard Conservancy 2011). The Imbewu project, in South Africa, involves local elders (usually retired Indigenous park rangers) and park rangers who take groups of eight disadvantaged young people on a four-day wilderness excursion to 'rediscover the relationship between their cultures and nature through the teachings of elders in a wilderness setting'. The aim of the program is to develop young leaders by bolstering self-confidence and pride while developing an interest in natural resource management and conservation (Wilderness Foundation 2012).

From these examples, it is evident that considerable importance is placed upon natural resource management across the world as a means of engaging Indigenous youth in education, training and employment which is culturally meaningful and brings together both traditional and western knowledge systems in addressing environmental issues of significance to young people.

Increasing the Engagement of Indigenous Youth in Natural Resource Management

There is general agreement among Indigenous organisations that Indigenous youth are under-represented in natural resource management. At the same time, this sector provides a culturally relevant means of addressing widespread Indigenous youth unemployment. What are the types of lessons that can be learnt from the many policies, activities and programs designed to increase youth engagement in natural resource management?

Although not specifically directed towards engagement in natural resource management, the policy framework in which Indigenous education and training operates in Australia points to best practice in engaging Indigenous youth in education, training and employment (Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) 2006; Ministerial Council on Education, Early Childhood Development and Youth Affairs (MCEECDYA) 2011). The development of science and place-based curricula to meet the needs of Indigenous students also suggest important features that should be considered when implementing strategies to increase Indigenous youth participation in natural resource management (e.g.

Fogarty 2011, 2012; Mitchell et al. 2008; Pickering Sherman, Van Lanen & Sherman 2010). In addition, the evaluation of several junior ranger programs in Australia and in Canada and less formal monitoring of other initiatives have identified best practice in achieving cultural, social and educational outcomes (e.g. Fogarty 2011; Fordham et al. 2010; Schwab 2006; Henry 2006).

Drawing upon each of the evaluation studies and curriculum policies mentioned above, and the diverse range of programs and activities we have reviewed, we have identified a number of critical issues vital to the development of strategies to increase Indigenous youth participation in natural resource management.

A more integrated approach to education and training

This review has identified a wide range of education, training and employment programs and activities to encourage Indigenous youth participation in the natural resource sector. This is especially the case in North America compared to the range and intensity of programs in Australia. However they tend often to be a disparate set of activities, very much dependent on government policy and funding priorities at the time. It is not surprising therefore that there has been a call for a more integrated approach to education, training and employment if progress is to be made in encouraging Indigenous youth to participate in natural resource management (Prince 2005; Taylor, Friedel & Edge 2009). The Australian Government's emphasis upon the development of training and employment pathways is consistent with this view (MCEECDYA 2011; MCEETYA 2006), although its application to the natural resource management sector has been quite limited.

Rather than identifying best practice in terms of a particular program or activity (which was the original intent of this review), we view best practice as a much more coherent approach to encouraging Indigenous youth participation in natural resource management. This approach emphasises the connectivity between Years K–12 schooling and post-secondary education and training, and between education, training, pre-employment and employment. It is highly sensitive to the importance of balancing the contributions of traditional and western knowledge systems and of social, cultural and academic learning outcomes. This approach recognises the rights, roles and responsibilities of various stakeholders in program development and delivery—Indigenous communities, education and training providers, Indigenous land councils and agencies, the private sector and government.

Youth as a priority

Indigenous agencies and communities recognise that lack of engagement of youth in natural resource management is a priority concern that needs to be addressed: This engagement is vital to meeting the demands of an expanding natural resource management sector arising from emerging environmental issues and modern technological developments. Importantly, greater youth engagement addresses the 'ageing' group of rangers and employees in the industry, where a strategic approach to succession planning is required. Engagement in natural resource management is also seen as a means of improving youth self-esteem and an alternative to less desirable social activities.

While Indigenous youth engagement is seen as a priority, it cannot be assumed that Indigenous youth are readily attracted to a career in the natural resource management. In a study of employment outcomes for the Maningrida Learning on Country program, a majority of graduates of the program subsequently gained employment in other industries (Fordham et al. 2010). It is essential to acknowledge that this does not detract from the importance of these programs; indeed it emphasises the value of investing in youth engagement to enhance job readiness for Indigenous youth across a range of employment opportunities.

Youth as a diverse target group

Youth as a target group comprise quite a diverse cohort. Within the 15–25 year old age range, young Indigenous adults may be enrolled in secondary education, enrolled in post-secondary education, employed or unemployed, or outside the labour force (i.e. neither employed nor unemployed and not actively seeking employment).

Each group brings with it particular challenges for those attempting to increase the engagement of Indigenous youth in natural resource management. Secondary school students have limited opportunity to participate in ranger activities unless such activities are an integral and accredited part of the school curricula. More often, involvement has been restricted to camps in summer breaks or 'special' excursions. However there are some cases of such integration (e.g. Kormilda College science curriculum in Northern Territory), and increased interest in the development of junior ranger programs within accredited school curricula in Australia.

Older youth with little work experience and training are most 'at risk' of being excluded from the labour market. These young people hold multiple barriers to employment in natural resource management. They may have extremely limited 'life skills', poorly developed pre-

requisite skills (including literacy and numeracy) relevant to natural resource management, and lack 'work readiness'. Strategies to encourage their participation in natural resource management will therefore concentrate more on developing basic entry-level skills. The Workplace English Language and Literacy Program administered by the Australian Government is one such program developed to address workplace literacy and numeracy that has been used in increasing the work readiness of Indigenous youth in natural resource management (e.g. Kimberley College of TAFE (Western Australia) and Taminmin College (Northern Territory) in recent years (DEEWR 2011b). By contrast, post-secondary students graduating in science and technology may be better placed for gaining entry into more professional jobs, requiring well-developed science, mathematics and technical skills. Encouragement for these students will largely depend upon strong partnerships between community, industry and their tertiary institution — as evident in several North American programs associated with the forestry industry.

The issue of inclusion of non-Indigenous youth in strategies to encourage Indigenous youth in natural resource management programs, where this is practical, is an interesting consideration. In more remote localities there is generally very limited opportunity for non-Indigenous participation due to the small numbers in the population. As Henry (2006) notes with respect to JCR programs, such inclusion provides opportunities for increased cross-cultural understanding, strengthened relationships between Indigenous and non-Indigenous communities, and increased self-esteem among Indigenous participants who are competing equally with non-Indigenous participants. In this regard, the changing focus of the Parks and Wildlife Service NT to more school-based junior ranger programs in townships such as Katherine and Darwin is likely to generate learning programs involving all youth.

Greater attention should be paid to identifying suitable candidates for particular programs, taking account of their existing skills, prior work experience and current commitments. In this way, programs can be tailored to specific groups of youth and increase the likelihood of achieving expected employment outcomes in natural resource management.

Raising awareness about natural resource management among Indigenous youth

Within the Australian context, no explicit activities to increase awareness of natural resource management as an employment option were identified, apart from its general inclusion within school-based career counselling or through work experience opportunities. By contrast there were many North American youth conferences and youth outreach activities designed to increase awareness of

natural resource management as an employment pathway. Interestingly, such activities were often oriented towards emerging environmental issues such as climate change and maintenance of biodiversity rather than more general natural resource management.

A more strategic approach needs to be adopted toward youth engagement in natural resource management, with awareness raising as a key element. Assumptions of a natural connection with country for Indigenous youth, and an existing interest in natural resource management as an employment option—and understanding what employment in the sector might involve—are mistaken. Importantly, awareness-raising needs to occur in early secondary schooling so that relevant pathways can be developed, rather than towards the final years of secondary schooling.

Capacities and potential of Indigenous youth

A key element in Australian Directions in Indigenous Education 2005-2008 (MCEETYA 2006) is creating a culture of high educational and employment expectations; it is also central to addressing under-representation of First Nation youth in skilled employment in British Columbia (Prince 2005).

This requires a pedagogy that challenges and raises the expectations of those Indigenous young people involved in education or training. Working alongside rangers and senior land managers or traditional owners is one way of raising the expectations of young Indigenous students. By acting as role models, skilled in both the application of indigenous ecological knowledge and western science to land management issues, these accomplished individuals can demonstrate the highly skilled job opportunities open to Indigenous youth, particularly those job opportunities tackling the emerging challenges of climate change, carbon abatement and maintenance of biodiversity.

Encouraging Indigenous young people to enter the more professional job market which requires well-developed scientific and technical skills is a critical factor for First Nation and Metis youth participation in the oil industry—and this is equally applicable to land management (Taylor, Friedel & Edge 2009). Indigenous and non-Indigenous scientists working with rangers, especially young rangers, on Indigenous Protected Areas in Australia or alongside First Nation, Metis and Native American youth in the Yukon River Inter-tribal Watershed or the Coastal Salish Gathering can act as role models and inspiration for Indigenous youth to seek more scientific and technical occupations. This group of scientists not only legitimate expected course outcomes but also define those outcomes in terms of ‘cutting edge’ science that underpins the most up-to-date land and sea management practices. An example of this is the involvement of Crocodylus Park, the

Queensland Museum and both Queensland and Melbourne Universities in junior ranger programs in northern Australia as an accredited part of the secondary school science curriculum.

Pathways development and natural resource management

A recurring feature of education policies for increasing Indigenous youth employment is the importance of education and training pathways leading to sustainable employment. At a practical level, for natural resource management this means:

- a high degree of connectivity between relevant courses, generally science, information technology and technical courses, across secondary education, training and higher education that are accessible by Indigenous youth
- counselling Indigenous youth about the types of jobs that are, or will be likely to be, available in natural resource management, including skilled jobs that will require well developed technical and scientific analytical skills
- providing Indigenous young people with information about education and training courses that will lead to particular types of jobs in natural resource management at an early stage of secondary schooling—too often the provision of such information occurs in final years of secondary schooling
- tailoring support for Indigenous youth as they participate in different stages along a career pathway in natural resource management
- developing well-articulated programs of training and mentoring for those entering or already employed in the sector which will assist in retention of Indigenous youth, and
- creating job opportunities for Indigenous young people who have demonstrated their capacity for jobs requiring technical and scientific analytical skills—and subsequent training and mentoring.

It is of concern that this review has not identified a strong focus upon pathways development—rather it would appear that stakeholders such as education systems assume that programs or activities of themselves are a pathway to increased Indigenous youth participation in natural resource management.

Importance of science, technology and mathematics skill development

Effective natural resource management is reliant upon well-developed scientific skills and knowledge in areas such as conservation ecology, population dynamics, animal husbandry and plant propagation, sustainable harvesting as well as skills in data collection, processing and analysis using quite advanced technology. These skills will be required to address the emerging issues of decline in biodiversity and impact of climate change and to take up opportunities for developing alternative and hybrid natural resource management industries as a basis for job creation and economic development. For this reason, increased skill levels in science, technology and mathematics amongst Indigenous youth is a priority for increasing their participation in the natural resources sector. The highly technical approach to monitoring water quality in the Salish Seas and the data collection and modelling underlying the tracking of changes in biodiversity in northern Australia attest to the importance of young Indigenous people having access to science and mathematics skills. Similarly, skilled occupations in the resource extraction industries require a background and experience in science, technology, engineering and mathematics.

Without skills training in these areas Indigenous youth will not have the necessary skills to enter employment in the sector or, if they gain employment and do not have adequate training, they will be restricted in the type of work they can undertake, itself leading to reduced job satisfaction, general disillusionment and low retention rates.

Skill development leads to an overall increased capacity of Indigenous communities to access science and technology information and improve decision-making about critical natural resource management issues. Such issues may include to Indigenous land use agreements, biodiversity maintenance, carbon abatement schemes and sustainable harvesting of wildlife among others. As youth represent the next generation of decision-makers for their communities, developing the necessary skills and understandings to take on this responsibility is a crucial investment in the future.

Complementarity of western science and traditional knowledge

An emphasis upon science, technology and mathematics is a challenge for those responsible for training Indigenous youth. Rather than focusing solely upon western science, training needs to recognise and incorporate Indigenous traditional knowledge in natural resource management. Indigenous ecological knowledge is an integral part of the overall set of skills and knowledge that can be applied to land management by Indigenous people. This complementarity of western science and Indigenous

ecological knowledge in natural resource management has been well documented in the literature (e.g. Fordham et al. 2010; Snively & Corsiglia 2001).

From the examples studied for this review, it is clear that both western science and Indigenous ecological knowledge perspectives are required for effective land management practices by Indigenous people. This applies equally to land management in remote regions as well as to rural localities where Indigenous people have a long history of land management. For example, the farming communities of the Oneida Nation, who hold a very close connection with their land, combine traditional agricultural customs with more contemporary farming practices. The spiritual connection of the Salish tribes with the sea underpins their monitoring of water quality as they travel ancestral waterways on their annual Tribal Canoe Journey, measuring sea-surface temperatures, salinity, pH, turbidity and dissolved oxygen using multi-parameter sondes with GPS. The Journey integrates these scientific procedures with traditional means of gathering information about marine habitats. Similar examples demonstrating the importance of this complementarity between western science and Indigenous ecological knowledge can be found in the management of Canadian forests by First Nation and Metis settlements.

The joint contribution of both knowledge systems underpin many land management practices for the Indigenous people of northern Australia. One example is the combining of traditional and western science to use traditional burning practices in reversing weed infestation and biodiversity decline in the tropical savannas of Cape York Peninsula (Commonwealth of Australia 2006) as well as in carbon abatement programs (NAILSMA 2006).

Incorporating Indigenous ecological knowledge into strategies to encourage youth participation in natural resource management serves two purposes. First, it reaffirms the cultural responsibilities of stewardship over land for youth, thereby emphasising the cultural relevance of training and employment in the sector. Second, combining Indigenous ecological knowledge and western science has the potential to provide more effective and enduring management practices. Both these factors serve to create more meaningful employment for Indigenous youth and encourage longer-term employment in the sector.

Science curricula, indigenous knowledge and a place-based pedagogy

In order to increase Indigenous youth participation in the sciences, the development of science curricula that complement the aspirations, skills, knowledge and spirituality of Indigenous students has gained strong support among some science educators. For this group, science teaching needs to be closely land- and sea-based

if it is to incorporate Indigenous ecological knowledge with western science and be meaningful to Indigenous youth.

The Native American Science Curriculum, developed by the Universities of New Mexico, Alaska (Anchorage), Northern Arizona and Kansas, is specifically designed to enable Indigenous themes and topics to be thoroughly documented and addressed openly in the classroom. This counters the tendency in more westernised science curricula to ignore Indigenous perspectives of natural phenomena. For example, tertiary courses are offered in Indigenous Research Methods, Native and Western Views of Nature and Natural Resource Management from an Indigenous perspective (Native American Science Curriculum 2011).

What constitutes a 'culturally responsive science curriculum' was also examined by the Alaska Science Consortium (Stephens 2000), which emphasises the need for science curricula and teaching practices to relate to the surrounding cultural and physical environment – that is, to 'place'. Similarly, a review of Indigenous-based science perspectives in Saskatchewan First Nations and Metis Communities found that student success in school science must address the idea of learning Indigenous science in relation to 'place' as well as generalised science curricula (Mitchell et al. 2008). This emphasis upon 'place' and activity-based learning having a direct application to community and future employment opportunities is evident in the well-developed pedagogy which underpins the JCR program (Schwab 2006).

The challenge for the education and training of Indigenous youth is the need to develop a place-based pedagogy which enables students to develop understandings of (western) scientific concepts without significantly altering their traditional spiritual view of the world, of being able to blend both knowledge systems and move freely between them. From their work in remote northern Australia and Canada respectively, both Fogarty (2011) and Snively and Corsiglia (2001) describe instructional strategies to achieve this blend of both Indigenous knowledge and western science perspectives and the adoption of a place-based pedagogy. What this entails goes beyond the insertion of some modules on Indigenous knowledge into an otherwise traditional curriculum.

Responsibility for developing an Indigenous science curriculum

Where might the impetus for the development of an Indigenous science course in the Australian context come from? To date, there have been several examples of outstanding science teachers who have adapted the Commonwealth or State science curriculum frameworks to include Indigenous perspectives. Likewise, there is

support from the mining sector and the Western Australia government for the development of a science curriculum that is culturally relevant to Indigenous children at the primary school level (Scitech 2012). We have already noted the changing focus of the Parks and Wildlife Service NT educational programs to include in partnership with schools Indigenous knowledge and customary practices. Although there are other initiatives, in general adaptations of science curricula underpinned by Indigenous perspectives have been dependent on particular individuals rather than embedded in a curriculum policy framework—and have been transitory in nature. As a result these curriculum developments have not had widespread application, especially across remote Indigenous communities where almost all students are Indigenous and where increased capacity for natural resource management is most needed.

Rather than being solely reliant upon government departments for an Indigenous science curriculum, professional science bodies and science education and teaching organisations and university faculties, in partnership with peak Indigenous education bodies, could have a role to play in the development of Indigenous science curricula. This would ensure a complementarity of Indigenous ecological knowledge and western scientific knowledge in science curriculum development. It would also ensure Indigenous science curricula are directed towards key scientific principles and include cutting edge science and not simply incorporate Indigenous issues of a topical nature.

Due largely to extremely limited numbers of Indigenous people employed in the science professions in Australia, the role of these peak organisations to date has unfortunately been limited in promoting science and science-related occupations among Indigenous young people. By contrast, organisations such as the American Indian Science and Engineering Society play a far more influential role in course development and furthering employment opportunities among Native Americans. It may well be that the newly formed School of Australian Indigenous Knowledge Systems at Charles Darwin University could function in a similar way to the Alaskan Native Knowledge Network, based at the University of Alaska, in supporting land- and sea-based curriculum development.

Elders and mentors

Involving elders with responsibilities for teaching Indigenous knowledge directly in education, training and employment programs is an important feature of successful strategies to engage youth. This was evident in the programs associated with the Canadian natural resources sector (Parsons & Brake 2006) and has been identified by Australian Aboriginal land councils (e.g. Central Land Council 2010; NLC 2010). Such involvement can be formally

recognised. There are examples of Elders being certified as instructors of traditional knowledge within the schooling system, with certification being viewed as an important legislative initiative to strengthen culture and language (e.g. Arctic College News 2011).

The intergenerational transmission of Indigenous knowledge and its importance to young Indigenous people cannot be assumed. This has already been highlighted earlier by Jana, Koss and Facer (2008), who noted the influence of modernity on the behaviour of Indigenous young people. Similarly, groups such as the Wimmera Catchment Management Authority (2011) in commenting on the Caring for our Country program realistically noted that the passing on of traditional knowledge to young people by elders is much more difficult than might be expected due to an 'ever-changing and highly technical world'. In a review of Aboriginal land and sea management in northern Australia (Sithole et al. 2008) it was pointed out that some attempts by elders to pass on Indigenous knowledge to young people were rejected due to the latter's fear of accepting the obligations which accompany such knowledge. In other situations Indigenous youth did not have the opportunity to gain traditional knowledge about the management of their land because those responsible for its transmission had not themselves had the opportunity of receiving the knowledge. Henry (2006) notes that the role of elders in JCR programs requires further development; this applies equally to courses in natural resource management. Studies of remote Australia indicate to us that traditional owners living on country tend to restrict their conversations to sites of special significance and ancestral stories, rather than the transmission of traditional ecological knowledge related specifically to land management and sustainable wildlife harvesting (Fordham et al. 2010). How best to encourage them to talk about relevant traditional ecological knowledge, within the context of on country training courses, remains a challenge for those responsible for course delivery.

Community as a basis for encouraging youth in natural resource management

A feature of several North American programs we have reviewed is the importance placed upon community involvement. The collaborative project between Natural Resources Canada, Canadian Forest Service and the Metis Settlements General Council is a case in point (Henry & Anderson 2004, 2005). In this instance, work experience projects developed for the encouragement of Aboriginal youth in forestry technician occupations were not generic projects applicable to the range of settlements. Rather, they were projects specific to individual settlements and seen as a priority by those communities. Similarly, projects selected to underpin the junior ranger program in Maningrida were of direct benefit to the local community and had solid

community backing from the local Aboriginal Council and the school's Indigenous Board.

Tensions and inconsistencies with government policy

Strategies to increase youth engagement in natural resource management may be contingent upon several government policies and associated funding programs. Not all policies may be consistent in terms of expected outcomes and this can apply to both the same and different levels of government. For example, Learning on Country programs being developed in Australia are directly linked to outcomes expected from the Indigenous Education Action Plan and the Indigenous Employment Program established by DEEWR. While both include a focus upon pathways development, each approaches the attainment of employment outcomes from a somewhat different perspective. The former, with its emphasis upon education, is less concerned with particular or predetermined employment outcomes but rather with improved job readiness across a range of jobs. The latter program is predicated upon a much tighter relationship between type of training and employment outcome achieved. The former adopts a longer term perspective whereas the latter is much more short term in the expected achievement of employment outcomes. Such a short term perspective may be suitable for older jobseekers or those who have already left school. However, it is not necessarily appropriate for secondary school students where program requirements may distort the type of Learning on Country strategy which is best suited to engaging Indigenous young people.

In discussing several initiatives to encourage Indigenous youth engagement in the natural resource sector with stakeholders, the extent of inter-governmental collaboration was raised. Where there is a lack of collaboration among government agencies, it is difficult to achieve effective delivery of quite complex programs of the sort required to address Indigenous youth engagement in the natural resource sector. Government agencies with their own responsibilities and funding guidelines for environmental management, employment, education and training, and youth social issues may need to develop new strategies for working together at the local level. Such strategies would include the joint application of funding guidelines and how to collaborate in a consistent manner with Indigenous stakeholders.

The importance of effective collaboration and good governance across all stakeholders

The number and diversity of stakeholders involved in the delivery of strategies such as Learning on Country programs or other strategies to engage Indigenous young people may require innovative governance structures

and protocols. This is particularly important where quite different types of institutions are jointly responsible for program delivery and where stakeholders hold different cultural orientations—for example where government schools, staffed largely by non-Indigenous teachers, and Indigenous ranger organisations, staffed by Indigenous people, are working together. In the case of natural resource management, good governance (e.g. using tools such as Memoranda of Understanding), is required to balance cultural obligations and institutional requirements, relative emphases upon Indigenous knowledge and western science in curricula, expectations of priority outcomes, and relative responsibilities when resources are limited.

Sector investment in Indigenous youth

A common characteristic across many programs and activities designed to encourage Indigenous youth participation in the natural resource sector is the direct involvement of the sector itself—including industry, specialist professional organisations and post-secondary educational institutions responsible for training prospective employees in the sector.

The role of professional organisations and industry in developing career guides, speaker programs, workshops for Indigenous youth on relevant issues, providing internships or traineeships, camps for students, community support programs and school visits has been a significant factor in increasing Indigenous participation in the sector. This becomes a problem for those parts of the sector that do not have the capacity to deliver such services. Localised Indigenous non-government organisations often have funding restrictions that render them unable to resource promotional activities of the sort required to encourage youth participation in natural resource management. Regional Indigenous non-government organisations such as Aboriginal land councils may experience similar difficulties. In such circumstances, there is greater reliance upon government programs to encourage youth participation.

Evaluation, flexibility and monitoring success

There has been limited evaluation of the effectiveness of strategies to increase youth participation in natural resource management, either in Australia or in North America. While the major evaluations relate to youth participation in the Canadian forest industries, the findings are relevant to other natural resource industries and to land management in general (e.g. Henry & Anderson 2004, 2005; Parsons & Brake 2006; Prince 2005; Taylor, Friedal & Edge 2009). The evaluation of several junior ranger programs in Australia and in Canada have identified best practice in achieving cultural, social and educational outcomes (e.g. Fogarty 2011; Fordham et al. 2010; Henry 2006; Schwab 2006).

The broad range of activities used to encourage youth participation in natural resource management enables a flexible approach to be taken, tailored to meet individual community and employer needs. Parsons and Brake (2006) and others have reinforced the importance of this flexibility. However this flexibility needs to be embedded within an overall strategy to avoid ‘cherry-picking’ of various activities which may not yield the outcomes expected. For this reason it becomes critical to monitor the effectiveness of particular activities as well as overall impact on Indigenous youth participation in the sector. Whilst this appears obvious, the lack of evaluative information in the available literature about the effectiveness of particular strategies, programs and activities attests to this as a priority need.

In developing an evaluation framework for strategies designed to increase Indigenous youth engagement in natural resource management, identification of the range of intended and unintended outcomes becomes critical. Again, we use research from CAEPR on Learning on Country programs as an indication of the range of outcomes to be included in an evaluation. This research has demonstrated that outcomes may be achieved for students, teachers, Indigenous rangers and the local Indigenous community—and that each needs to be monitored. There may be organisational benefits for the school as a whole and for the Indigenous agency responsible for ranger activities. There is also a growing body of research to suggest that there are broader social outcomes (such as reduced involvement in the criminal justice system) for young people participating in natural resource management activities that could be also be monitored.

Concluding Comment

This review brings together two priority areas of government policy, both applicable across international settings. The first is the alarmingly high rate of Indigenous youth unemployment. The second is the importance of natural resource management to address emerging environmental issues concerned with decreasing biodiversity, pollution of waterways, land degradation, and the potential impact of climate change. Although there is diversity in the programs and activities to engage Indigenous youth in natural resource management, there are continuing concerns among Indigenous industry and government stakeholders that much more could be done in this regard. Of the critical issues influencing the success of programs and activities, the major one is the need for greater appreciation by all stakeholders of the complexity involved in establishing clearly articulated pathways for Indigenous youth to enter and then retain employment in the natural resource sector. This complexity applies to the range of stakeholders and their capacity to collaborate effectively, recognition of the cultural, social and academic

determinants of Indigenous youth engagement and acknowledgment that programs and activities cannot be reliant upon short-term funding arrangements.

Strategies such as Learning on Country or junior ranger programs can operate as an integral part of the secondary school curricula and hold major promise. These programs provide the opportunity from an early age for Indigenous young people to become increasingly aware of natural resource management as an employment option and to develop the necessary scientific and technical skills to be ready to enter a wide range of environmental occupations. More importantly, these programs are a means of maintaining spiritual connection to country, of

ensuring intergenerational transmission of Indigenous traditional—and especially ecological—knowledge, and engendering stewardship responsibilities. Yet Learning on Country programs for secondary school students will not suffice. Such programs must be seen as one very important first stage along an education, training and employment pathway. A seamless connection to tertiary studies accompanied by strong mentoring will ensure that Indigenous youth do not continue to be limited in achieving their potential to enter specialist occupations in natural resource management.

Notes

1. For the purposes of this paper the term 'natural resource management' covers land and sea management, sustainable wildlife industries management, and natural resource extraction industries such as mining, natural gas, oil and forest industries.
2. This review tends to use the term 'Indigenous people' to include all North American people who are regarded as 'native to the area' and only refers to First Nations, Metis, Inuit or Native American people when considering specific programs and activities. See, e.g. Aboriginal Infant Development Programs (n.d.) for discussion of terms.
3. The Harvard Project on American Indian Economic Development (2011) is a rich source of information on First Nation involvement in natural resource management. The Harvard Project suggested these programs had a strong youth engagement and education and training component and would be good examples of how best to engage Indigenous youth in natural resource management.

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